IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application for:

    Steven Teig

Serial No.:   10/046,926

Filing Date: 01/13/2002

For: ROUTING METHOD AND APARATUS

Examiner: Siek, Vuthe

Group Art Unit: 2825

AMENDMENT AND RESPONSE TO OFFICE ACTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated 01/23/2006, please amend the patent application as follows:

Amendment to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks begin on page 7 of this paper.

AMENDMENT TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application. The following listing provides the amended claims with deleted material crossed out and new material underlined to show the changes made.

Claims 1-5　　(Canceled)

6.　　(Currently Amended)　A method of defining global routes for nets in an arbitrary region of a circuit layout, wherein each net has a set of pins, the method comprising:

　　a)　　using a first set of lines to measure length of the global routes;

　　b)　　using a second set of lines to measure congestion of the global routes;

　　c)　　using a third set of lines to partition the arbitrary region into a first set of sub-regions; and

　　d)　　for each net, identifying a global route that connects a group of first-set sub-regions that contain the net's set of pins, wherein each of at least a plurality of global routes is not collinear with segments of said first, second, and third sets of lines.

7.　　(Original)　　The method of claim 6, wherein the second and third sets of lines are identical.

8.　　(Currently Amended)　A method of defining global routes for nets in an arbitrary region of a circuit layout, wherein each net has a set of pins, the method comprising:

　　a)　　using a first set of intersecting lines to measure length of the global routes, wherein the first set of lines defines a first set of sub-regions within the arbitrary region of a circuit layout;

b)   using a second set of intersecting lines to measure congestion of the global routes;

c)   for each net, identifying a <u>global</u> route that connects a group of first-set sub-regions that contain the net's set of pins; wherein each global route has a set of route segments, <u>wherein each of at least a plurality of the global routes intersects with lines of said first and second sets of lines and does not have any segment that is collinear with the first and second sets of lines,</u> and each route segment connects two sub-regions in the first set of sub-regions.

9.   (Currently Amended)   The method of claim 8, further comprising measuring the length of each global route by summing the length of each global route segment in the <u>global</u> route's set of route segments.

10.   (Previously Presented) The method of claim 9, wherein using the second set of lines comprises measuring the congestion of the global routes across the second set of lines.

11.   (Previously Presented) The method of claim 10, wherein the second set of lines define a plurality of congestion edges, wherein measuring the congestion of the global routes comprises measuring the congestion of routes across the congestion edges.

12.   (Previously Presented) The method of claim 11, further comprising:

once a global route is completed, specifying each global route only with respect to the global route's segments that cross the congestion edges.

13.   (Currently Amended)   The method of claim 8, wherein identifying the global route for each net comprises:

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starting at a first-set sub-region that contains a pin of the net, successively specifying a route segment that expands the _global_ route into a new first-set sub-region until the _global_ route connects all the group of sub-regions that contain the net's pins.

14.   (Previously Presented) The method of claim 13, further comprising:

at each expansion of a global route segment, computing a length cost;

for each expansion of a global route segment across a second-set line, computing a congestion cost based on the congestion of the second-set line.

15.   (Previously Presented) The method of claim 13,

wherein specifying a first global route segment comprises examining a plurality of potential global route-segment expansions;

wherein for each potential global route-segment expansion, computing a length cost;

wherein if the potential global route-segment expansion intersects a second-set line, computing a congestion cost based on the congestion of the second-set line.

Claims 16-20   (Canceled).

21.   (Currently Amended) A computer program embedded in a computer readable medium, the computer program for defining global routes for nets in an arbitrary region of a circuit layout, the computer program comprising sets of instructions for:

using a first set of lines to measure length of the global routes;

using a second set of lines to measure congestion of the global routes;

using a third set of lines to partition the arbitrary region into a first set of sub-regions; and

identifying for each net, a global route that connects a group of first-set sub-regions that contain the net's set of pins wherein each of at least a plurality of said global routes is not collinear with segments of said first, second, and third sets of lines.

22.   (Currently Amended) A computer program embedded in a computer readable medium, the computer program for defining global routes for nets in an arbitrary region of a circuit layout, the computer program comprising sets of instructions for:

using a first set of intersecting lines to measure length of the global routes, wherein the first set of lines defines a first set of sub-regions within the arbitrary region of a circuit layout;

using a second set of intersecting lines to measure congestion of the global routes; and

identifying for each net, a global route that connects a group of first-set sub-regions that contain the net's set of pins; wherein each global route has a set of global route segments, wherein each of at least a plurality of the global routes intersects with lines of said first and second sets of lines and does not have any segment that is collinear with the first and second sets of lines, and each global route segment connects two sub-regions in the first set of sub-regions.

Claims 23-27   (Canceled).

REMARKS

In the Office Action, the Examiner rejected claims 6-13, and 21-22 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 6,260,183, issued to Raspopovic et al. ("Raspopovic"). The Examiner also rejected claim 14 under 35 U.S.C. § 103(a) as being unpatentable over Raspopovic in view of U.S. Patent 5,875,117, issued to Jones et al. ("Jones"). The Examiner objected to claim 15 as depending from a rejected base claim.

In this Amendment, Applicants have amended claims 6, 8, 9, 13, and 21-22. Accordingly, claims 6-15 and 21-22 will be pending after entry of this Amendment.

I.   Rejection of Claims 6-7 under § 102(b)

The Examiner rejected claims 6-7 under § 102(b) as being as being anticipated by Raspopovic. Applicants have amended claim 6.

Claim 7 depends directly on claim 6. Claim 6 recites a method of defining global routes for nets in an arbitrary region of a circuit layout. Each net has a set of pins. The method includes using a first set of lines to measure the length of the global routes, using a second set of lines to measure congestion of the global routes, using a third set of lines to partition an arbitrary region into a first set of sub-regions, and for each net, identifying a global route that connects a group of first-set sub-regions that contain the net's set of pins. Each of at least a plurality of global routes is not collinear with segments of said first, second, and third sets of lines.

Accordingly, claim 6 recites a global routing method that defines global routes that are not co-linear with the lines used to measure the lengths of the routes. Raspopovic does not disclose, teach or even suggest such a global routing method. Raspopovic does not explicitly state that the lengths of the

routes are calculated using a set of lines. Raspopovic states that the length of routes is determined by the real coordinates of their respective pins (see Raspopovic Figs. 9-10 and col. 16, lines 55-56). Furthermore, Raspopovic states "The actual routing graph consists of points 84 and the lines connecting them 85." (See Raspopovic, Figure 19, and Col 23, lines 46-48). Thus the lines Raspopovic uses, though not explicitly for measurement, are collinear with the global route lines. This is in contrast to claim 6, in which the global route is not collinear with the set of lines for measuring the length of the route. Applicants are amending claim 6 for clarification, and not for reasons of patentability. Applicants do not surrender any equivalents of amended limitations.

In view of the foregoing remarks, Applicants respectfully submit that Raspopovic does not anticipate or otherwise render invalid the method of claim 6. Given that claim 7 is dependent on claim 6, Applicants respectfully submits that the cited reference does not render unpatentable claims 6-7. Accordingly, Applicants respectfully request reconsideration and withdrawal of the §102(b) rejections of claims 6-7.

II.   Rejection of Claims 8-14 under § 102(b), § 103(a)

The Examiner rejected claims 8-13 under § 102(b) as being as being anticipated by Raspopovic. The Examiner also rejected claim 14 under § 103(a) as being unpatentable over Raspopovic in view of Jones. Applicants respectfully traverse these rejections as explained below, but has amended claim 8 in the interest of expeditious prosecution.

Claims 9-14 depend directly or indirectly on claim 8. Claim 8 recites a method of defining global routes for nets in an arbitrary region of a circuit layout. Each net has a set of pins. The method includes using a set of intersecting lines to measure the length of the global routes. The set of lines

defines a set of sub-regions within the arbitrary region of a circuit layout. The method includes using a second set of intersecting lines to measure the congestion of the global routes. The method includes, for each net, identifying a global route that connects a group of first-set sub-regions that contain the net's set of pins. Each global route has a set of route segments. Each of at least a plurality of the global routes intersects with lines of the first and second sets of lines and does not have any segment that is collinear with the first and second sets of lines, and each route segment connects two sub-regions in the first set of sub-regions.

Accordingly, claim 8 recites a global routing method that defines global routes that have segments that are not co-linear with segments of the lines used to measure the lengths of the routes. Raspopovic does not disclose, teach or even suggest such a global routing method. Raspopovic does not explicitly state that the lengths of the routes are calculated using a set of lines. Raspopovic states that the length of routes is determined by the real coordinates of their respective pins (see Raspopovic Figs. 9-10 and col. 16, lines 55-56). Furthermore, Raspopovic states "The actual routing graph consists of points 84 and the lines connecting them 85." (See Raspopovic, Figure 19, and Col 23, lines 46-48). Thus the lines Raspopovic uses, though not explicitly for measurement, are collinear with the global route lines. This is in contrast to claim 8, in which the segments of the global route are not collinear with segments of the lines for measuring the length of the route. Applicants are amending claim 8 for clarification, and not for reasons of patentability. Applicants do not surrender any equivalents of amended limitations.

In view of the foregoing remarks, Applicants respectfully submit that Raspopovic does not anticipate or otherwise render invalid the method of claim 8. Given that claims 9-14 are dependent directly or indirectly on claim 8, Applicants respectfully submit that the cited reference does not render

unpatentable claims 8-14. Accordingly, Applicants respectfully request reconsideration and withdrawal of the §102(b) and 103(b) rejections of claims 8-14.

III. Rejection of Claim 21 under § 102(b)

The Examiner rejected claim 21 under § 102(b) as being as being anticipated by Raspopovic. Applicants respectfully traverse these rejections as explained below, but has amended claim 21 in the interest of expeditious prosecution.

Claim 21 recites a computer program embedded in a computer readable medium. The computer program defines global routes for nets in an arbitrary region of a circuit layout. The computer program includes instructions for using a first set of lines to measure length of the global routes, using a second set of lines to measure congestion of the global routes, using a third set of lines to partition the arbitrary region into a first set of sub-regions. The computer program includes instructions for identifying for each net, a global route that connects a group of first-set sub-regions that contain the net's set of pins. Each of at least a plurality of global routes is not collinear with segments of the first, second, and third sets of lines.

Accordingly, claim 21 recites a global routing method that defines global routes that are not co-linear with the lines used to measure the lengths of the routes. Raspopovic does not disclose, teach or even suggest such a global routing method. Raspopovic does not explicitly state that the lengths of the routes are calculated using a set of lines. Raspopovic states that the length of routes is determined by the real coordinates of their respective pins (see Raspopovic Figs. 9-10 and col. 16, lines 55-56). Furthermore, Raspopovic states "The actual routing graph consists of points 84 and the lines connecting them 85." (See Raspopovic, Figure 19, and Col 23, lines 46-48). Thus the lines Raspopovic uses,

though not explicitly for measurement, are collinear with the global route lines. This is in contrast to claim 21, in which the global route is not collinear with the set of lines for measuring the length of the route. Applicants are amending claim 21 for clarification, and not for reasons of patentability. Applicants do not surrender any equivalents of amended limitations.

In view of the foregoing remarks, Applicants respectfully submit that Raspopovic does not anticipate or otherwise render invalid the method of claim 21. Accordingly, Applicants respectfully request reconsideration and withdrawal of the §102(b) rejections of claims 21.

IV.   Rejection of Claim 22 under § 102(b)

The Examiner rejected claim 22 under § 102(b) as being as being anticipated by Raspopovic. Applicants respectfully traverse these rejections as explained below, but has amended claim 22 in the interest of expeditious prosecution.

Claim 22 recites a computer program embedded in a computer readable medium. the computer program is for defining global routes for nets in an arbitrary region of a circuit layout. The computer program has instructions for using a first set of intersecting lines to measure length of the global routes. The first set of lines defines a first set of sub-regions within the arbitrary region of a circuit layout. The computer program has instructions for using a second set of intersecting lines to measure congestion of the global routes. The program also has instructions for identifying for each net, a global route that connects a group of first-set sub-regions that contain the net's set of pins. Each global route has a set of global route segments. Each of at least a plurality of global routes intersects with lines of the first and

second sets of lines and does not have any segment that is collinear with the first and second sets of lines. Each global route segment connects two sub-regions in the first set of sub-regions.

Raspopovic does not disclose, teach or even suggest such a global routing method. Raspopovic does not explicitly state that the lengths of the routes are calculated using a set of lines. Raspopovic states that the length of routes is determined by the real coordinates of their respective pins (see Raspopovic Figs. 9-10 and col. 16, lines 55-56). Furthermore, Raspopovic states "The actual routing graph consists of points 84 and the lines connecting them 85." (See Raspopovic, Figure 19, and Col 23, lines 46-48). Thus the lines Raspopovic uses, though not explicitly for measurement, are collinear with the global route lines. This is in contrast to claim 22, in which the segments of the global route are not collinear with segments of the lines for measuring the length of the route. Applicants are amending claim 22 for clarification, and not for reasons of patentability. Applicants do not surrender any equivalents of amended limitations.

In view of the foregoing remarks, Applicants respectfully submit that Raspopovic does not anticipate or otherwise render invalid the method of claim 22. Accordingly, Applicants respectfully request reconsideration and withdrawal of the §102(b) rejections of claim 22.

V.   Objection to Claim 15 as depending from a rejected base claim

Applicants thank the Examiner for the allowance. However, Applicants believe that the herein amended base claim for claim 15 (claim 8) is not anticipated or otherwise invalid. Thus Applicants respectfully request reconsideration of the objection to claim 15.

VI. Amendment of claims 9 and 13

Applicants have amended claims 9 and 13 to clarify that the routes mentioned are global routes.

CONCLUSION

In view of the foregoing, it is submitted that all pending claims, namely claims 6-15 and 21-22 are in condition for allowance. Reconsideration of the rejections is requested. Allowance is earnestly solicited at the earliest possible date.

Respectfully submitted,

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Dated: <u>May 23, 2006</u>   /Mani Adeli/

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